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GEOPHYSICS, ASTRONOMY AND SPACE

No. 420

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GEOPHYSICS, ASTRONOMY AND SPACE

No. 420

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. METEOROLOGY

Abstracts of Scientific Articles

COMPARATIVE STUDY OF HAIL FORECASTING METHODS

Sofia KHIDROLOGIYA I METEOROLOGIYA in Bulgarian Vol 26 No 3, 1977 pp 50-57

[Article by P. Boev and E. Dragova]

[Abstract] The article considers the applicability of four methods for forecasting hail processes under the conditions prevailing in Bulgaria, specifically, the Stanchev method, which determines a complex of aerological-synoptic and thermodynamic parameters; the Glushkova method, which is based on the hail-formation mechanism; and the Shishkin and parcel methods, which use thermodynamic criteria for the development of convection. The first method is based on a semiempirical convective cloud model which allows for the nonadiabaticity of the cloud processes, while the rest use an adiabatic model of atmospheric convection, with its modifications, the parcel method and the layer method. Data for the western part of the Thracian lowland for the period from 15 April to 30 September 1975 were used to evaluate the applicability of the four investigated methods. The results indicate that the Stanchev, Glushkova and Shishkin methods can be successfully used to forecast hail processes in Bulgaria, with the Stanchev method being the most reliable.
[286]

THEORY OF ADVECTIVE CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 14, No 2, 1978 pp 149-156

[Article by L. T. Matveyev and S. A. Soldatenko, Leningrad Hydrometeorological Institute, "On the Theory of Advective Clouds"]

[Abstract] The authors present a numerical solution of a nonlinear system of heat and moisture transfer, motion and continuity equations describing the process of formation of an advective fog in the boundary layer of the atmosphere. For closing the system use is made of the equations of the

balance of turbulent energy and the expressions from similarity theory. It was possible to ascertain the conditions for the appearance of a fog and the patterns of the field of its liquid moisture content and also the vertical profiles of temperature and air humidity. The authors establish a dependence between the thickness and liquid-water content of a fog on the thermohygrometric characteristics of the air mass and the earth's surface. It is shown that under definite conditions a low cloud cover and a fog can be formed simultaneously.
[333]

SPECTRAL STRUCTURE OF RADIATION ATTENUATION IN RELATION TO SURFACE AIR LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 14, No 2, 1978 pp 157-169

[Article by A. I. Chavro, Yu. S. Georgiyevskiy, M. S. Malkevich and A. Kh. Shukurov, Institute of Atmospheric Physics, "Correlation Between the Statistical Characteristics of the Spectral Structure of the Attenuation of Radiation and Meteorological Parameters in the Surface Air Layer"]

[Abstract] A study was made of the statistical characteristics of the spectral structure of the coefficients of attenuation of radiation by the surface air layer in the windows of the visible and IR spectral ranges. It is shown that at low partial pressures of water vapor there is a dependence of the mean coefficients of atmospheric attenuation on mean relative humidity for the short-wave spectral region and on the mean absolute humidity in the long-wave region. At high partial pressures the mean coefficients of atmospheric attenuation are dependent on mean absolute humidity in the entire spectral range. The maximum dispersion of the atmospheric attenuation coefficients correspond to the maximum dispersions of absolute and relative humidity. The highest autocorrelation coefficients between attenuation in the visible and IR spectral ranges are observed under conditions of minimum atmospheric moistening, which confirms findings that there is a common factor involved in attenuation in the visible and IR spectral ranges. It is found that in both the visible and in the IR spectral ranges an important role in attenuation can be played by the finely disperse aerosol fraction.
[531]

II. OCEANOGRAPHY

Abstracts of Scientific Articles

VERTICAL DIFFUSION OF COSMOGENIC ISOTOPES IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol 18, No 1, 1978 pp 50-57

[Article by A. S. Vinogradov, Institute of Oceanology, "Vertical Diffusion of Cosmogenic Isotopes in Ocean"]

[Abstract] A study was made of the nonstationary problem of vertical diffusion of cosmogenic isotopes in the ocean. In accordance with the observed annual cycle it is assumed that the flux of isotopes at the ocean surface has constant and periodic components. The author has found a solution for a steady regime of change in concentration, which with an increase in depth becomes a stationary regime. It was possible to ascertain the limits of fluctuations of concentration and the reserve of some isotopes in the ocean. The article gives computations of the annual cycle of ^{7}Be and its comparison with experimental data. It was possible to demonstrate the influence of the annual cycle of cosmogenic isotope distribution on estimates of the coefficient of vertical diffusion.
[349]

NUMERICAL MODEL OF OCEAN CURRENTS ON SYNOPTIC SCALE

Moscow OKEANOLOGIYA in Russian Vol 18, No 1, 1978 pp 5-10

[Article by A. S. Sarkisyan, D. G. Seidov and Ye. V. Semenov, Institute of Oceanology, "Numerical Model of Ocean Currents on a Synoptic Scale"]

[Abstract] The article discusses a numerical model of computation of currents on a synoptic scale arising, developing and maintained by fluxes of heat and momentum through the surface. The numerical model is based on the splitting method and modeling of adequate processes by means of moving particles. It was established that upon attaining a definite energy level the motion becomes essentially of the eddy type. The dimensions of the eddies and their westward movement agree in the first approximation with the computations made earlier by W. R. Holland and L. B. Lin ("On the Generation

of Mesoscale Eddies and Their Contribution to the Oceanic General Circulation," J. PHYS. OCEANOGR., 5, No 4, 1975) for a two-layer model.
[349]

BALTIC SEA INVESTIGATIONS BY GAMMA SURVEY

Moscow OKEANOLOGIYA in Russian Vol 18, No 1, 1978 pp 85-89

[Article by V. M. Sobolev, V. V. Kostoglodov, N. N. Dunayev and V. P. Vasil'yev, Institute of Oceanology, "Investigation in the Baltic Sea Using a Continuous Underwater Gamma Survey (Fortieth Voyage of the Research Vessel 'Professor Dobrynin')"]

[Abstract] Expeditionary work during the 40th voyage of the research ship "Professor Dobrynin" was carried out in the Baltic Sea during the period 9-23 July 1976. The objectives of the survey were: investigating the possibility of using the radiometric method for detecting zones of tectonic dislocations on the sea floor; carrying out a comparative evaluation of the parameters of two types of towed underwater gamma detectors. It was found that the use of a continuous underwater radiometric survey with respect to total gamma radiation in the Baltic Sea at this stage in the research does not make possible a clear interpretation of the variation of the field of gamma radiation of bottom sediments over tectonic faults as a result of local enrichment of the sediments by radioactive elements along the tectonic dislocations. But this does not preclude the possibility of successful use of a gamma survey for detection of fault zones on the bottom of other sea areas. Gamma probes based on small scintillation detectors are convenient in operation but their use is desirable over those sectors of the bottom where a highly detailed survey is not needed. Larger detectors (150 x 100 mm or more) must be employed for a detailed gamma-spectrometric survey. Comparison of radiometric records obtained along lithology-facies profiles confirmed the high effectiveness of use of such a gamma survey in the mapping of bottom deposits.
[349]

III. TERRESTRIAL GEOPHYSICS

News

USSR SEISMIC STATIONS RECORD EARTHQUAKES

TASS Reports Earthquake in Southern Kuriles

Moscow PRAVDA in Russian 24 Mar 78 p 6

[TASS Report: "Underground Tremors"]

[Text] Yuzhno-Sakhalinsk, 23 March. A series of underground tremors has passed through the South Kurile Islands over the last two days. The earthquake reached force 6-8 at its epicenter, which is east of Iturup Island, in the Pacific.

TASS Reports Earthquake in Groznyy

Moscow IZVESTIYA in Russian 24 Mar 78 p 4

[TASS Report: "Earthquake in Groznyy"]

[Text] Groznyy, 23 March. (TASS) This morning at 0807 hours Moscow time the Groznyy seismic station registered an underground tremor of force 4.

The epicenter of the quake was located several kilometers from Groznyy. The underground occurrence did not cause damage to the city. There was no destruction and no casualties.

TASS Reports Earthquake in Kirgiziya and Kazakhstan

Moscow PRAVDA in Russian 26 Mar 78 p 6

[TASS Report: "Underground Tremors"]

[Text] Frunze, 25 March. (TASS) Today at 0006 hours Moscow time there was an earthquake in the mountainous regions of Kirgiziya and Kazakhstan.

The force at the epicenter, which was located in the mountains northeast of Lake Issyk-Kul', exceeded force 7 [on the Soviet scale], and in Frunze -- force 5. Underground tremors were recorded at Alma-Ata at force 6. In areas adjacent to the earthquake epicenter homes, animal shelters and other things were damaged. There were no casualties.

Earth Tremors Registered Near Magadan

Moscow Domestic Service in Russian 0900 GMT 29 Mar 78

[Text] A report from Magadan says that today at 0557 Moscow time earth tremors were registered in the region of the city.

As the Deputy Director of the Northeastern Combined Scientific Research Institute, Izmaylov, reported, the epicenter of the earthquake was approximately 100 kilometers south of Magadan, near the Koni Peninsula. The force of the earth tremor there was about force 6 on the Richter scale [sic] and in the region of Magadan weak tremors were registered, about force 4 on the Richter scale.

CONSTRUCTION OF NEW SEISMIC STATION IN PERM BEGUN

Moscow PRAVDA in Russian 22 Mar 78 p 6

[Article by V. Cherepanov: "How to Curb the Mountain Tremor"]

[Text] Construction of a new seismic station has begun at the "Severnaya" mine of the "Kizelugol'" Combine. The miners of the basin are not threatened by earthquakes, but due to transition to deeper horizons the danger may again appear of so-called rock collapse. The use of modern forecasting methods and the adoption of new equipment for working the deposit will ensure the safety of mining work.

Soviet scientists and specialists have succeeded in discovering and comprehending the mechanism of the phenomenon and finding effective methods for contending with it. The leading role in this was played by the All-Union Scientific Research Institute of Geomechanics and Mine Surveying. And the Kizelovskiy basin, where 30 years or more ago the first instances of such rock collapse were noted in our country, became a sort of singular test laboratory. It was found that the conditions for such calamities are most frequently created by man himself, and completely without suspecting this.

"Now we have learned how to predict precisely the place and intensity of possible rock collapses," states the deputy technical director of the "Kizelugol'" production combine V. Starosel'tsev. "First of all we work

the stratum, we determine the danger of the entire suite. We drill control holes and by means of instruments we register the intensity of the noises, what might be called "microimpacts," on the basis of which we give an evaluation of each stratum. First of all the coal is removed from the less stressed strata in order to lessen the rock pressure in the adjacent strata. Also of help in reducing pressure is the drilling of "unloading" holes, the driving of water into the stratum...

However, it must not be forgotten that in the earth's deep layers latent processes are constantly at work and that unseen forces are actively transpiring. So, for predicting regional seismics the basin has a seismic station. In the near future plans call for constructing two others. Using them one sensitively hears the "pulse of the earth's deep layers." The very slightest changes in the strength of the shaft field and soil oscillations are immediately registered by instruments and are studied by specialists, after which appropriate recommendations are made to the miners.

After such a complex of prophylactic measures the production of coal becomes safe.

The valuable experience accumulated in the Kizelovskiy basin has been put at the disposal of miners in other coal basins in the country and is being used successfully at the mining enterprises of Poland, Czechoslovakia and East Germany.

Scientists are asking themselves: is it possible that the viscious enemy can be made an ally of the miners? Is it possible to use the energy of rock pressure for the output of coal? Specialists at the institute have proposed their method for the production of underground fuel by means of the forced oscillation of the stratum itself.

The search for the most effective working "team" for contending with this phenomenon is continuing.
[343]

SUPERDEEP DRILLING CONTINUES IN APSHERON AND ON KOLA PENINSULA

Moscow IZVESTIYA in Russian 8 Apr 78 p 3

[Article by G. Dimov: "What is There, at a Depth of 15 km?"]

[Text] The drilling now being done at Apsheron and on the Kola Peninsula is of inestimable scientific and practical importance.

The limits of the earth's crust and the earth's upper mantle, which in the Apsheron area and on the Kola Peninsula lie at a depth of 10-15 km, beyond the Ural Range dip three or four times deeper. The first stage is drilling

to a depth of 8,200 m and this distance was recently successfully reached on the Kola Peninsula. Preparations have begun for the second stage -- a depth of 10,500 m. The third step downward will be a depth of 15,000 m. Knowing what the structure and compositions of the rocks are in these strata, scientists and geologists will seemingly be able to glance to a depth of 50-60 km in the Ural and Siberia regions.

Superdeep drilling is a continuation and development of methods which in general are familiar to geologists. The fabricator of the very powerful and unique equipment for such drilling is also well known -- the Ural Heavy Machine Building Plant. But the deeper you drill, the greater are the mysteries and the more reliable must be the tool. The instruments which register the curves of geological sections and the chemical composition of the earth's crust take and bring samples to the surface; these are also tested in practical work, are made at the Kiev Geophysical Instruments Plant.

The success of the experiment to a large extent is dependent on the geophysical cable by means of which the instruments lowered to the earth's mantle can be raised upward to the surface. Such a cable was fabricated at the combine "Sredazkabel'" in Tashkent. Within it there are current conducting strands; heat resistance is ensured by special insulation and strength is ensured by an armor of particularly strong steel. The armor will be the supporting element for the entire construction.

I talk with the chief designer of geophysical cables at the combine, M. Mar'-in. Together with the section chief Ya. Mesenzhik he heads a team engaged in the development of a cable for superdeep drilling. It appears that the earth's temperature on the Kola Peninsula at a depth of 8,000 m is greater than the computed value but the thermal resistance reserve in the cable is enough. At a depth of 10,500 m the temperature attains 210 degrees and at 15 km it reaches 350°.

In the first stage of the experiment use was made of a cable with a continuous length of 9 km. Now preparations are being made for fabrication of a cable for the second drilling stage. The working out of a project for a cable with a length of 15 km has already begun. In contrast to those made earlier it will be a multiprofile cable with a thickening toward the top. Only under this condition will it be able to withstand the apparatus, the ever-increasing pressure (it attains 3,000 atmospheres) and its own weight; after all, the length of the cable exceeds 16 km. Another peculiarity is its increased thermal resistance and the capacity for transmitting data from three types of research to the surface simultaneously. This reduces by a factor of three the number of raisings and lowerings for the replacement of instrumentation.
[360]

Abstracts of Scientific Articles

THE GEOID IN RELATION TO TECTONIC PROCESSES

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 5, 1977 pp 51-56

[Article by A. T. Zverev, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "The Geoid and Tectonic Processes"]

[Abstract] The most probable depth of the largest disturbing masses of the geoid is the boundary between the core and the mantle. Autochthonous matter participates in tectonic processes. The "oceanization" and "continent zation" of the earth's crust is a reflection of the development of different stages in a unified tectonic process. A considerable part of the energy necessary for the transpiring of tectonic processes is provided. by the heat transported from the core and mantle by gases, fluid solutions and magma melts. A gradual advance of the heating front toward the surface ensures the principal regularities in the development of geosynclinal processes. The propagation of the heating of matter to one side of the main zone is responsible for the centrifugal and undulating nature of development of geosynclines. Scale, differentiation, periodicity, amplitude and rate of development of tectonic processes are derivatives of the entire diversity of natural physicochemical processes which are accompanied by a change in volume, structure, mineralogical composition and movement of deep matter.
[350]

IV. UPPER ATMOSPHERE AND SPACE RESEARCH

News

CHRONOLOGY OF "SALYUT-6" MISSION 12-16 MARCH 1978

[Editorial Report] Moscow PRAVDA in Russian, dated 13-17 Mar 78, TASS provides the following information on activities aboard the manned space complex "Salyut-6--Soyuz-27":

12 March

Routine Activities

Romanenko and Grechko are continuing to observe and photograph areas of the earth's surface within the territorial limits of the USSR. They are also exercising on the comprehensive trainer while wearing the pneumo-vacuum suit "Chibis," which creates negative pressure in the lower part of their bodies (PRAVDA 13 Mar 78 p 1).

Medical Report

According to the results of a comprehensive medical examination conducted on 11 March, the pulse rate and blood pressure of Romanenko are 66 and 140/60; of Grechko -- 70 and 135/55. The examination confirmed that their cardiovascular systems are stable and that their ability to work remains high (PRAVDA 13 Mar 78 p 1).

13 March

Crew Prepares for Return to Earth

The crew has begun operations to conserve the station's on-board systems and scientific equipment and to service both the station and the transport ship. Wearing their "Chibis" vacuum suits, the cosmonauts are exercising on the comprehensive trainer (PRAVDA 14 Mar 78 p 3).

Optical Properties of Windows Inspected

Cosmonauts Romanenko and Grechko are photographing the windows of the space station in order to determine whether they become scratched during orbital spaceflight (PRAVDA 14 Mar 78 p 3).

Parameters of Microclimate Given

The following parameters are given for the microclimate maintained within the space complex:
-- temperature, 22 degrees Centigrade;
-- pressure, 78 mm Hg. (PRAVDA 14 Mar 78 p 3)

14 March

Preparations for Return Continue

The crew is continuing to prepare the station for automatic flight and the "Soyuz-27" transport ship for return to the earth.

Also included in the day's flight program are: physical exercise in the "Chibis" vacuum suits, work with technical documentation and photography of Soviet territory (in particular, over the Baykal-Amur railroad) (PRAVDA 15 Mar 78 p 1).

15 March

By 1300 hours Moscow time "Salyut-6" had completed 2,638 revolutions of the earth; a crew was on board for 1,484 of them.

Preparations for Return Continue

The crew is conducting final operations to conserve the on-board systems and equipment of the "Salyut-6" station and to prepare "Soyuz-27" for its return to earth. They are transferring film cassettes, flight documentation and research materials into the descent vehicle and used equipment into the crew compartment of the transport ship.

Physical exercise in the "Chibis" vacuum suit continues to be an important activity (PRAVDA 16 Mar 78 p 1).

16 March

On 16 March 1978 at 1100 hours Moscow time "Soyuz-27" separated from the "Salyut-6" station and at 1419 hours softlanded 265 kilometers west of Tselinograd. "Salyut-6" continues its flight in an automatic mode.

A preliminary medical examination showed that cosmonauts Romanenko and Grechko are doing well after their long flight in space (PRAVDA 17 Mar 78 p 1).

The reports of 13-16 Mar 78 include statements on the crew's good health and the normal operation of all on-board systems. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-996"

Moscow PRAVDA in Russian 29 Mar 78 p 3

[TASS Report: "'Kosmos-996'"]

[Abstract] The artificial earth satellite "Kosmos-996" was launched in the Soviet Union on 28 March 1978. The satellite was inserted into an orbit with the following parameters:
-- initial period, 104.8 minutes;
-- apogee, 1,021 kilometers;
-- perigee, 970 kilometers;
-- orbital inclination, 82.9 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-997" AND "KOSMOS-998"

Moscow PRAVDA in Russian 31 Mar 78 p 3

[TASS Report]

[Abstract] On 30 March 1978 in the Soviet Union the artificial earth satellites "Kosmos-997" and "Kosmos-998" were launched by a single rocket booster. The satellites were inserted into an orbit with the following parameters:
-- apogee, 230 kilometers;
-- perigee, 200 kilometers;
-- orbital inclination, 51.6 degrees. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-999"

Moscow PRAVDA in Russian 31 Mar 78 p 3

[TASS Report: "'Kosmos-999'"]

[Abstract] The artificial earth satellite "Kosmos-999" was launched in the Soviet Union on 30 March 1978. The satellite was inserted into an orbit with the following parameters:
-- initial period, 89.8 minutes;
-- apogee, 376 kilometers;
-- perigee, 180 kilometers;
-- orbital inclination, 71.4 degrees.

ROMANENKO AND GRECHKO ADJUST TO EARTH CONDITIONS

Moscow PRAVDA in Russian 31 Mar 78 p 3

[TASS Report: "The Cosmonauts Are Writing Their Report"]

[Summary] Two weeks after the completion of their record-breaking 96-day orbital flight, cosmonauts Yu. Romanenko and G. Grechko are practically back in shape. According to the latest medical examinations, they have adjusted to terrestrial conditions "without complication."

Romanenko and Grechko are processing flight documentation and, together with cosmonauts Gubarev and Remek, are reporting to mission specialists, scientists and engineers. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1000"

Moscow PRAVDA in Russian 2 Apr 78 p 1

[TASS Report: "'Kosmos-1000' in Orbit"]

[Abstract] The artificial earth satellite "Kosmos-1000" was launched in the Soviet Union on 31 March 1978. The satellite was inserted into an orbit with the following parameters:
-- apogee, 1024 kilometers;
-- perigee, 978 kilometers;
-- initial period, 104.9 minutes;
-- orbital inclination, 83 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1001"

Moscow PRAVDA in Russian 5 Apr 78 p 3

[TASS Report: "'Kosmos-1001'"]

[Abstract] The artificial earth satellite "Kosmos-1001" was launched in the Soviet Union on 4 April 1978. The satellite was inserted into an orbit with the following parameters:
-- initial period, 88.7 minutes;
-- apogee, 249 kilometers;
-- perigee, 205 kilometers;
-- orbital inclination, 51.6 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1002"

Moscow PRAVDA in Russian 7 Apr 78 p 3

[TASS Report: "'Kosmos-1002'"]

[Abstract] The artificial earth satellite "Kosmos-1002" was launched in the Soviet Union on 6 April 1978. The satellite was inserted into an orbit with the following parameters:
-- initial period, 89.4 minutes;
-- apogee, 305 kilometers;
-- perigee, 209 kilometers;
-- orbital inclination, 65 degrees.

The satellite carries a radio transmitter operating on a frequency of 19.995 MHz.

COMMENTARY ON "KOSMOS" SERIES SATELLITES

Moscow IZVESTIYA in Russian 2 Apr 78 p 2

[Article by V. Avduyevskiy: "The 1000th 'Kosmos' in Orbit"]

[Text] The thousandth "Kosmos" satellite has been launched into an orbit around the earth. During the time which has elapsed since 16 March 1962, when the first vehicle of this series was launched, the "Kosmos" vehicles have won a solid place in the arsenal of means for exploring space in the investigations carried out by the Soviet Union. At the request of the editors, V. S. Avduyevskiy, Corresponding Member USSR Academy of Sciences, tells about the importance of the "Kosmos" satellites for science and the national economy.

The different means developed by space technology have afforded new possibilities not only for development of the fundamental sciences, but also for their practical use in the interests of the national economy, television broadcasting, superdistant telephonic and telegraphic communication, meteorology.

"Kosmos-1000" is a space navigation beacon, using which sea ships with a high accuracy will be able to determine their position at any point in the world ocean, regardless of weather conditions. It forms part of a satellite navigation system consisting of similar vehicles.

The importance of such a system is obvious. The data obtained from navigation satellites make possible a substantial reduction in the duration of transoceanic voyages. This gives an annual saving amounting to many hundreds of millions of rubles.

A long-range weather forecast is a highly complex problem facing science. This requires that meteorological observations simultaneously cover enormous areas of the land and sea. Such a possibility can be afforded only by artificial earth satellites. Already for more than ten years in our country there has been continuous operation of the "Meteor" meteorological space system. The creation of Soviet meteorological satellites was preceded by much scientific research, experimental design and general experimental work. For the first time it was initiated on the satellites "Kosmos-4" and "Kosmos-23." Later came special vehicles of the type "Kosmos-122," the satellites "Kosmos-144" and "Kosmos-156," and also the "Kosmos-184," "Kosmos-206" and "Kosmos-226" and others.

Today we know that the sun is a decisive factor in our terrestrial climate. It is necessary to know how much solar energy enters the earth's atmosphere, how it is absorbed by different air layers, and how much is backscattered into space.

Many flights of "Kosmos" satellites have been directed to solution of the problems of atmospheric physics and solar-terrestrial relationships.

The "Kosmos-243" and "Kosmos-384" and others were the first to be used in the testing of new radiophysical methods for remote sensing of the parameters of the atmosphere, ocean and surface of the continents. They afforded the possibility of an all-weather study of the properties of the environment using artificial satellites. These methods are now coming into use in a meteorological space system, the "Meteor" system.

It would seem that only very recently did space communication come into existence, but today by means of satellites there are transmissions of Central Television to virtually the entire population of our country. The space satellite communication line also has a great number of channels for the transmission of telephone conversations, telegrams and teletype communications, including newspaper mats. The contribution of the "Kosmos" satellites to the creation of a distant space communication system in our country is especially great.

We should mention the use of satellites of the "Kosmos" series for solution of such problems of importance for human economic activity as, for example, investigation of the earth's magnetic field. Data on magnetic declination

are used extensively in the exploration for minerals, in navigation and aviation. Artificial satellites are making it possible to carry out magnetic surveys far more rapidly and over a considerably greater part of the earth's surface than was possible by surface methods. For the first time the "Kosmos" satellites made possible a magnetic survey which covered the earth's entire surface and it was carried out virtually simultaneously.

The "Kosmos" satellites also found use in branches of knowledge related to the study and rational use of the environment. A space survey, capable of routinely collecting information immediately from an enormous area, is exceedingly important for forestry and agriculture, the effective solution of problems in ocean fishing and geological exploration and research.

With an increase in the duration of flights and increasing complexity of their programs increasing importance is being attached to problems relating to the development of means for eliminating or at least lessening negative flight factors. For this is was necessary to make a more detailed study of the mechanisms of the influence of spaceflight factors on living organisms, to improve and create new life support systems. Many of these problems were also assigned to satellites of the "Kosmos" family.

Using the "Kosmos" satellites Soviet scientists for the first time put telescopes beyond the limits of the earth's atmosphere for observing the entire spectrum of electromagnetic waves from orbit over the course of a long time.

One of the links in the extensive program for investigating the sun by "extraterrestrial" methods was the launching of special, so-called solar satellites of the "Kosmos" series which were intended for investigation of the short-wave radiation of our sun. As a result of these experiments a study was made of the principal parameters of X-radiation in all the characteristic stages of solar activity, with measurement of the absolute flux of radiation and its variations and localization of X-ray active regions in the solar atmosphere. Important data were obtained on the dynamics and spatial structure of solar flares.

Prolonged measurements carried out using the "Kosmos" satellites made it possible to compile maps of the distribution of fluxes of particles of different nature in near space in a broad energy range.

Sometimes satellites of the "Kosmos" series are called a test polygon of space technology. The experiments carried out with them have given answers to many technical problems associated with the further mastery of space. They were used in checking out individual components of the "lunokhod." The "Kosmos" vehicles were employed in testing methods for automatic docking in orbit. These and other experiments brought us closer to the possibility

of creating orbital scientific stations with a long lifetime.

In a newspaper article it is impossible to tell about all the investigations carried out by satellites of the "Kosmos" series. But even from these short notes it can be seen how significant their contribution is to the study of space.
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CONDITION OF GRECHKO AND ROMANENKO REPORTED

Moscow IZVESTIYA in Russian 18 Mar 78 p 3

[Article by B. Konovalov: "A Happy Return Home"]

[Text] At the Baykonur cosmodrome, at the "Kosmonavt" hotel, Yu. Romanenko and G. Grechko were greeted by A. Gubarev and V. Remek with the traditional bread and salt. One should see the happy faces of the four friends when they all got together again, now once again on their native earth.

On the eve of the landing of Romanenko and Grechko we conversed with Professor Yu. Nefedov and other specialists of the Institute of Biomedical Problems. They were very optimistic in evaluating the health of the cosmonauts and felt that despite such a prolonged stay in a state of weightlessness Romanenko and Grechko withstood normally their return to terrestrial gravitation. Exercises in a space "stadium" and special prophylactic measures undertaken before the finish should give a good result. This prediction was completely justified.

We saw that the faces of the cosmonauts had not grown lean, were satisfied and happy. The director of the postflight medical examination A. Beregovkin and a well-known specialist in the field of space medicine, USSR flier-cosmonaut B. Yegorov, confirmed our subjective evaluations. According to objective data from the rapid medical examination made, the feeling of well-being of the cosmonauts is entirely normal. To be sure, now it is difficult to readapt to terrestrial gravity, but this was expected. There were no unpleasant surprises.

In the hall it seemingly becomes lighter from the smiles of the cosmonauts when they approach us for a short conversation.

"The doctors say that you are now not having an easy time, but you are smiling, so what's the story?" we ask.

"The doctors are correct," responds Romanenko. "It is difficult to adapt to the earth. And we are smiling because we are happy. We are happy because we were able to make a long flight and implement the program. We are happy because we are on the earth, among friends."

"Now it is difficult for us, our heads are like those of babies, it is difficult to hold them up," says Grechko. "But there is a feeling of joy and lightness from the awareness that our duty has been done."

"Recall your first sensations on the earth."

Romanenko: "When the searchers opened the hatch cover we were struck by a stream of cold winter air. It was so delicious that it could be drunk in big gulps. The day was wonderful, the sun was shining and the snow was sparkling. And there was much joy from this winter beauty."

Grechko: "I was landing for a second time. And, you know, the terrestrial air produces the strongest impression. It is very special to be on your own native earth."

"And what seemed to you to be more difficult -- adjustment to weightlessness or now again become accustomed to terrestrial gravity?"

Romanenko: "It seems to me that readjustment to terrestrial gravity is more difficult. When you enter a state of weightlessness, you sense discomfort, a rush of blood to the head. But nevertheless, there is a lightness of movements and you float. But here the entire body becomes like lead and it is difficult to hold up your head."

Grechko: "I agree with Yury that it is more difficult to tolerate gravity than weightlessness. But the methods for readaptation are being improved and this has its effect."

The ten minutes allocated to us are exhausted. We thank the cosmonauts and they go on for their next examination. The medical "conveyor belt" is today operating intensively.
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GRECHKO AND ROMANENKO INTERVIEWED

Moscow IZVESTIYA in Russian 21 Mar 78 p 3

[Article by B. Konovalov: "Evaluation: 'Excellent'"]

[Excerpt] "Ninety-six days in space -- that, to be sure, is difficult work," says Georgiy Grechko. "The fact that we were able to retain our high performance is attributable to a great extent to the stable daily schedule and the improvement of comfortable conditions on the orbital station. On the 'Salyut-4' we worked in accordance with a so-called sliding schedule. The workday was displaced in such a way as to take in the zone of maximum radiovisibility of the territory of our country. This is very inconvenient for the crew. The body gets out of rhythym. But on the 'Salyut-6' we got up

and laid down at approximately one and the same time: 0800 and 2300 hours. To be sure, it was not so simple to create such a regime for the earth. The number of sea ships was increased in order to lengthen the time for the control center to be in contact and 'Molniya' satellites were extensively used for this purpose. On the other hand, the result was a gain in crew performance."

"In my opinion, a major role was played by the improvement in diet. On board the 'Salyut-4' Gubarev and I covered everything abundantly with 'Moldova' sauce. But now it is virtually not used. The canned goods even without this were tasty. It was pleasant to consume really heated food and eat warm bread. The visiting expeditions brought us fresh fruits, bread, mustard and horse radish."

"Also of importance was the possibility of taking a shower, although it, to be sure, was experimental and only was undergoing its first tests."

"We got a great deal of satisfaction from the 'videomagnetophone,' especially from recordings of our relatives. These recordings were delivered from the earth by our friends. And in the evening you view films and immediately your heart is warm."

"We were very pleased when we were visited by our guests Dzhanibekov and Makarov, and then by Gubarev and Remek," states Yuriy Romanenko. "To be sure, the volume of work then increased and being hosts on the station we had to assist our guests. But the four of us worked more happily and it was more interesting."

"With the 'Pamiry' we sent away the results of some experiments and observations and the 'Zenity' brought us the speedy response of specialists. This feedback was extremely valuable, especially for the visual observations of geological structures, volcanoes, the world ocean and different phenomena in the upper atmosphere, to which we devoted much attention."

"With special impatience we waited for the development on the earth of the films sent back with Gubarev and Remek. After all, not much time remained and we had photographed interesting phenomena, such as the aurora. Here much is dependent on the proper calculation of exposure, the setting of the diaphragm during the taking of photographs. We wanted to take new photographs, taking into account the results of the processing. Therefore, during the last days of presence in orbit we slept little, striving to do a little more. But probably if we still had a month more in flight it would not have been possible to do everything which we wanted to do."

Each of the cosmonauts selected a strategy for contending with gravity after return from weightlessness in accordance with their own character. Georgiy Grechko lies down more and exhibits caution, taking into account his past experience in readaptation after a monthlong flight.

"For me the most important thing is not to get back to normal rapidly, but to do so reliably so that I can again fly into space." Yuriy Romanenko is a man of action. His active nature cannot tolerate lying around. Therefore he walks and sits more. But both want air, to be warmed in the spring sun. And they were happy when the doctors permitted their first stroll... [341]

RYCHLEWSKI PREDICTS POLISH COSMONAUT WILL FLY THIS YEAR

Warsaw ZYCIE WARSZAWY in Polish 13 Feb 78 pp 1, 2

[Interview with Prof Jan Rychlewski, Chairman of the Space Research Committee of the Polish Academy of Sciences, Secretary of the Division of Mathematical-Physical, Chemical and Geological-Geographic Sciences of the Polish Academy of Sciences, by newspaper and television reporters: "Cooperation Among the Socialist Nations in Space Research"]

[Text] Cooperation among the socialist nations in the area of space exploration was the subject of a press and TV interview with Prof Dr Hab Jan Rychlewski, Chairman of the Space Research Committee of the Polish Academy of Sciences and Secretary of the Mathematical-Physical, Chemical and Geological-Geographic Sciences Division of the Polish Academy of Sciences.

[Question] As we know, training for joint manned missions including citizens of the socialist nations has been in progress for a year and a half now. How did this undertaking come about?

[Answer] Manned space missions constitute an exceptionally important part of the space exploration program and, we might add, a part which is of great interest to the public. After the space age was ushered in by the USSR, following the memorable flight by Yuriy Gagarin, other socialist countries gradually became involved in activities in this area. It was a rather modest beginning -- regular observations were made to determine movement of satellites. In 1967, at the initiative of Soviet scientists, it was decided to introduce planning and coordination into cooperation among the socialist nations in this area. The Interkosmos program was launched, carried out by scientists from the USSR, Poland, Czechoslovakia, the GDR, Bulgaria, Hungary, Romania, Mongolia, and Cuba. Since that time we have met each year, specifying collective joint research plans. This year's meeting will be held in Poland. The Interkosmos program encompasses a very broad range of undertakings in the area of space physics, meteorology, biology and medicine, communications and telemetry. The program pursues both general cognitive goals, enriching our knowledge about the earth, near-earth space, and the solar system, and practical goals in the area of natural

resources, the environment, communications, weather forecasting, geodesy, and cartography. Implementation of this program became possible thanks to the genuinely fraternal, magnanimous and unselfish attitude of the Soviet Union, which offers use of its rockets and space hardware for all undertakings, without charge. This is outstanding equipment, which all of us had the opportunity to view at last year's exhibit in Poland. In 1976 the Soviet Union came forth with a new and important initiative, proposing that joint manned space missions be included in the Interkosmos cooperative program. It was specified that manned missions including citizens of all the countries participating in Interkosmos would be flown by 1983. Cosmonauts from the USSR, Czechoslovakia, GDR, and Poland will take part in the first phase of these manned missions. As we know, cosmonaut candidates from these countries are completing training at Star City near Moscow.

[Question] Could you discuss participation in the Interkosmos program by Polish scientists?

[Answer] Poland possesses the requisite conditions for active participation in cooperative space exploration: a growing and continuously-updated production potential, a corresponding scientific and engineering potential, and highly-qualified cadres of scientists, technicians and workers. Our well-developed departments of exact sciences, which have a solid tradition in this country, form the intellectual foundation for our participation. Our participation dates from 1958, when 11 satellite tracking stations were established in Poland. Within the framework of the Interkosmos program we conducted a number of experiments on board Vertikal geophysical rockets as well as on board satellites of the Interkosmos series. Our most substantial enterprise was the Copernicus-500 satellite scientific program. This was an innovative program to study bursts of solar radio-frequency radiation. The equipment supplied by us and the obtained results were highly praised by our partners. We have also participated successfully in building a number of complex instruments, such as laser equipment to measure distance to satellites. From the very beginning we have attached considerable importance to application of results in the nation's economy: in communications, meteorology, natural resource studies, and cartography. The Polish Academy of Sciences Space Research Center was established in 1976, and a national program was adopted for study and utilization of near-earth and interplanetary space. Our contribution has been substantial, and in recent years it has increased considerably although I do not believe it has yet reached a level proportionate to our country's potential, and will continue to be intensified.

[Question] Returning to the joint manned missions, can you briefly describe their purpose and significance?

[Answer] Space research has presently entered a qualitatively new phase. The period of scientific "reconnaissance," initial gathering of data is now behind us. A period of systematic, profound investigation has begun. Space is becoming a site of normal scientific work and engineering-technical

activities. Now one of the major items on the agenda is the establishment of permanent laboratories in space manned by substantial crews formed in the future by scientists and specialists in addition to professional cosmonauts, laboratories linked by regular passenger and cargo service with earth. The entire program of joint missions within the Interkosmos program is subordinated to this highly important and promising concept. It follows from this that these missions will be major components of advances in conquering space and will constitute a qualitatively new, important stage in this area. The scientific and technical aspects of the joint program of manned missions are highly diversified, encompassing experiments in the area of space physics, space technology, study of the earth from space, communications and space technology, biological and medical experiments. A number of Polish scientific establishments are taking part in preparing these experiments. I should like to emphasize the determining role played by Polish military research establishments in the selection and initial training of candidates for these missions. I believe there will be plenty of time in the future for more detailed presentation of these matters. At this point I should like to emphasize that the innovational importance of the planned joint missions goes far beyond purely scientific and technical problems. The conquest of space constitutes a global problem, such as the problem of raw materials and energy, the problem of environmental protection, the problem of utilization of the resources of the seas and oceans. These problems are of interest to mankind as a whole, will increasingly affect the lives of all peoples, and their solution demands peaceful cooperation by all nations. The Soviet initiative calling for joint activities in space by multinational crews constitutes an excellent example of internationalist policy, one of the fine forms of expression of unity among the socialist countries.

[Question] General Vladimir Shatalov, head of Soviet cosmonaut training, stated in a TASS interview that it would take at least 18 months to train personnel from the socialist countries. This period is now up. When are we going to see a Pole in space?

[Answer] Space flight constitutes a unique feat. It is a scientific and technical accomplishment, the groundwork for which is laid by large teams of scientists, technicians, and workers. It is also a personal accomplishment on the part of the cosmonauts, who for good reason are awarded the highest honors for their feats. The main point, however, is the fact that today man is going into space to work, to perform a complex research program. Space research missions within the framework of Interkosmos constitute one limited aggregate, a sequence linked by a common technical plan and a unified scientific program. This program is to be carried out by cosmonauts from four countries: the Soviet Union, Czechoslovakia, Poland, and the German Democratic Republic. I shall not be revealing any big secret by stating that in actual fact the combined Soyuz-26-Salyut-6-Soyuz-27-Progress-1 mission constitutes the first stage of this program. This stage has been successfully carried out by Soviet cosmonauts. As we know, Salyut-6, with Yuriy Romanenko and Georgiy Grechko on board, has been refueled and resupplied and is ready to continue the mission. Now the subsequent stages await us. A specific portion of the program will be executed in each stage. In respect to

the scientific program, I should like to emphasize that it includes experiments with preparations contributed by a number of countries as regards the plan and instrumentation. One can easily see what a complicated thing it is to set up the entire program and specify its phases as well as determining the personnel to carry it out. At a conference in Moscow in July 1976 we reached a joint decision that all these matters will be determined directly by those officials in charge of the scientific and technical aspects of the missions. They were also empowered to determine which individual among the cosmonauts in the training group will perform the individual program tasks. We specialists realize that the sequence of missions will also proceed from the considerations of execution of specifically defined and suitably distributed tasks and stages of the program, prepared jointly by scientists from the collaborating countries and totally execution-supported by the mighty Soviet space technology potential.

[Question] So the selection of mission crews depends chiefly on the scientific program and the scope of scheduled research and experiments....

[Answer] This much I can say at present on this subject. Our cosmonauts -- excellent pilots and officers -- are preparing to carry out one of the most important stages of the program. We have reason to believe that the portion of the program earmarked for Polish cosmonauts contains new, highly complex tasks, demanding long, intensive preparations. It is definite, however, that this year we shall have the proud experience of observing a Polish cosmonaut in orbit. I saw the entire group of cosmonauts from the Soviet Union, Poland, Czechoslovakia and the GDR, working together harmoniously at Star City. They are stout-hearted, excellently trained and capable individuals. We wish them all the greatest success in space, in accomplishing this great common enterprise.
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FEOKTISTOV COMMENTS ON FUTURE OF ORBITAL STATIONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 12 Apr 78 p 3

[G. Lomanov interview with Feoktistov: "Road to the Stars"]

[Excerpt] [Question] How do you envisage the future of orbital stations?

[Answer] They will develop above all as multipurpose scientific laboratories. Medical and biological experiments making it possible to ascertain how long man can live and work in space without harming his health will continue on board the stations. As before, great significance will also attach to manned stations for the study of natural resources. The highly effective nature of this work has already been proved by practice. It is no accident that in the past two years the number of organizations using space information in the interests of the national economy has doubled.

The unique potentials of orbital stations will also be used for exoatmospheric astronomical observations and for technological experiments making it possible to obtain materials which under terrestrial conditions cannot be obtained at all or are too costly. In short, in fulfilling national economic goals the orbital stations will also serve to seek out the most effective methodologies for developing research methods and the design of scientific instruments and equipment.

The problem of the optimum distribution of duties between man and machine is becoming increasingly topical with the increase in the duration of space flights. There is much that is controversial here: some specialists believe that space is, above all, a sphere for the operation of machines. There is justification for their arguments: for instance, astrophysical observations even in the immediate future could be carried out with the aid of preprogrammed apparatus. Studies of natural resources are also perfectly within the powers of modern radio- or program-controlled television equipment. But it is still people who have to develop the methods for this research and correlate the degree to which the information obtained by machine jibes with the real picture.

In my view, very broad prospects are opening up for manned stations if they are examined above all as the basis for industrial construction in space. Not everyone shares this view but I personally believe that within the next few decades the development of technology will make it possible actually to undertake the creation of power plants in space. These installations, gigantic by present standards, covering tens of square kilometers, will trap solar energy and transmit it in a transformed form for use on earth. With time, technological experiments will lead to the creation of real industrial enterprises in orbit.

And this means that millions of tons of diverse equipment will have to be put into space and enormous and complex structures will have to be assembled there. Such work can scarcely be fully automated. People, large groups of people, moreover, will control the equipment and conduct installation operations. Of course, this will not happen rapidly and many people may relegate such forecasts to the realm of fantasy. But after all, 17 years ago Yuriy Gagarin's flight also seemed a fantastic achievement.

SHATALOV REPORTS ON TRAINING OF POLISH AND GDR COSMONAUTS

Moscow TASS in English 1840 GMT 24 Apr 78

[Text] Moscow, 24 April. TASS. Representatives of the GDR and Poland are being trained for a space flight, according to plan, Lieutenant General Vladimir Shatalov told a TASS correspondent.

After a Polish cosmonaut makes a flight on board the "Salyut" orbital station together with Soviet cosmonauts, a representative of the German Democratic Republic will make a space flight, said Vladimir Shatalov, who supervises the training of Soviet cosmonauts. He expressed confidence that the citizens of Poland and the GDR will be fully prepared for the flight and that the results of all previous flights will be taken into consideration.

General Shatalov pointed specifically to a thorough training of representatives of the GDR. Each of them has a good command of Russian, studies technology in great detail and is training in harmony with Soviet cosmonauts.

The flight program, said Vladimir Shatalov, will undoubtedly be largely similar to the program that was implemented on board the orbital station "Salyut-6" with the participation of a citizen of the Czechoslovak Socialist Republic Vladimir Remek. But it will also include various experiments that the GDR scientists plan to stage on board the orbital station.

Shatalov said that space cooperation under the "Interkosmos" program with participation of citizens of Socialist countries considerably widens the scope of scientific research and experiments in space. Scientific instruments and equipment of these countries are installed not only on unmanned spacecraft, but also on manned spaceships and orbital stations.
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COMMENTS ON FINAL STAGE OF "SOYUZ-27" SPACEFLIGHT

Moscow TRUD in Russian 17 Mar 78 p 2

[Article by V. Golobachev: "A Feat in Space"]

[Excerpts] Yesterday [16 March] the 97th day of the space flight of Yu. Romanenko and G. Grechko began at 0430 hours. They awoke at 0300 hours, had breakfast, ended the mothballing of the station and began to make preparations for undocking with the hospitable "Salyut-6," which for more than a quarter of a year had been their real home.

Casting a farewell glance around the compartment of the orbital station, Romanenko and Grechko slowly floated into the "Soyuz-27" ship and began to close the hatches. Then, as usual, they proceeded to a checking of the tightness of the docking by the use of sensitive instruments, making sure that there is no leakage of the atmosphere into space. This checking is carried out over a definite period of time. Then the cosmonauts donned their spacesuits, entered the descent module of the ship, closed the hatch and released some pressure in the orbital compartment.

"During two minutes the pressure in the descent module did not change," reported Romanenko.

This means that there is also no atmospheric leakage here. The cosmonauts asked for permission to undock. They worked calmly and without hesitation, joked and their voices betrayed no traces of excitement, such as would seem natural at this moment when such a long flight was being completed and a speedy encounter with the earth was anticipated.

"You can find us there a more level and softer landing spot," laughs Grechko, "such as for the 'Zenity' and 'Pamiry'."

"It will be still better," responds the Control Center operator in the same spirit. "And if a tractor is in the neighborhood, we'll do some plowing..."

At 1101 hours the "Soyuz-27" departed from the station. Soon the mooring and orientation engines were fired, putting the ship at an increasingly greater distance from the "Salyut-6." The television camera on the ship relayed a direct report to the earth. It was still more than three hours or two revolutions around the earth before landing (the computed time was 1419 hours).

On the next revolution the director of training of Soviet cosmonauts, Lieutenant General of Aviation V. A. Shatalov, reported to the crew the last meteorological summary from the landing region, gave some advice and wished them a "soft landing."

Forty more minutes passed and a communication was received from the tracking ship in the western hemisphere stating that at 13 hours 31 minutes 8.7 seconds the engine used for braking had been fired and the "Soyuz-27" had entered a descent trajectory. Now accelerations should begin...

The cosmonauts were ready for them. The night before we had had a conversation with specialists in the field of space biology and medicine -- the deputy director of the Institute of Biomedical Problems, recipient of the State Prize Professor Yu. G. Nefedov, Professors L. I. Kakurin and I. I. Bryanov, and Doctor of Medical Sciences A. D. Yegorov. They were completely satisfied with the state of Yuriy Romanenko and Georgiy Grechko and noted their high performance, absence of apathy, creative mood and sense of humor. Medical examinations of the commander and ship's engineer were carried out aboard the orbital complex, together with the most different tests with and without physical loads. These investigations demonstrated that the reactions of the cosmonauts do not exceed the anticipated bounds. An enormous amount of research work precedes the prolonged extraterrestrial flights. Here is only one, and possibly not the clearest example. At the Institute of Biomedical Problems a study was made of the effect of different spaceflight factors. Groups of test subjects were selected (note that these people are not very young, an age of about 40 years, such is also approximately the average age of the flying cosmonauts). For more than three months the test subjects laid motionless on slanting beds in such a way that the blood at all times

flowed to the head. In this way it was possible to simulate one of the manifestations of weightlessness and also hypokinesia (restricted mobility). Another group also laid with their heads sloping downward, but from time to time they engaged in physical exercises.

Deep investigations in space and on the earth enabled the doctors to draw an important conclusion: man can for months work in orbit but with adherence to definite conditions -- regular medical examinations, implementation of prophylactic measures, firm schedule of work and rest... The doctors insisted on this so that beginning with the 24th day of the flight the six-day work week for Romanenko and Grechko was replaced by a five-day work week (after which there was time off), so that not less than eight hours would be devoted to sleep, so that the cosmonauts would have personal time and time for carrying out their favorite, so—called personal initiative investigations (this is also its own sort of rest).

Approximately after four to six weeks of flight Romanenko and Grechko experienced a relative stabilization of body functions. That is, upon reaching a definite level, there was no additional decrease in the volume of the muscles and other functions. To be sure, there were definite fluctuations (even on earth a man's pulse frequently changes), but all this was within definite limits. A study of body adaptation to weightlessness is very important for specialists. For example, a flight to Mars can have a minimum duration of three years. In case of necessity the ship would not return to the earth and would not land at any time. It is necessary to know precisely whether the human body could contend with such a flight, what preventive measures would be required and whether it is necessary to develop an appropriate biomedical strategy... All this must be known in order to ensure effective operation of long-term orbital stations in circumterrestrial space.

In the flights of Soviet cosmonauts the system of prophylactic measures developed by specialists has completely justified itself. On the present flight this system included, in particular, exercises in a space "microstadium," special suits, and much else.

On the last days before landing Romanenko and Grechko, in accordance with the recommendations of the physicians, did not exercise on the bicycle-type ergometer, but worked only with the "treadmill" (for 1 1/2 hours each). In addition, for two hours daily they trained in a vacuum outfit, the "Chibis." Taking into account that in space there is a change in the content of fluids and salts in the cells and tissues of the organism, the cosmonauts on the eve of the landing had to drink a great deal. On the last day of flight they took salt tablets and did so with water or juice. (The salt is necessary in order to hold the fluid in the body).

Prior to landing Romanenko and Grechko donned special anti-g suits. Before landing these suits were inflated and they impeded the rapid flow of blood to the legs...All this enables the cosmonauts to contend more easily with

terrestrial gravitation, which they had not felt for more than three months. But for the time being they are only approaching the earth...

"The accelerations are increasing," says the commander. "But they are still not very great..."

The descent module, like a meteor, has penetrated the upper layers of the atmosphere and has reduced velocity...The landing, like the entire flight, goes off splendidly. The descent module has arrived precisely in the calculated region and the parachute has opened. Communication was immediately established with the aircraft and helicopters of the search groups.

At 1419 hours the descent module made a soft landing 265 km to the west of Tselinograd.
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BEREGOVOY PREDICTS ENERGY INSTALLATIONS IN SPACE

Moscow TRUD in Russian 11 Apr 78 p 4

[I. Yudin interview with G. T. Beregovoy: "Beyond the Limits of the Earth"]

[Excerpt] High-capacity heliostations can be constructed in space, giving us on earth the possibility of using part of the great energy of the sun. Plans for them already exist. Space will become the industrial foundation of future humanity. Under the specific conditions of space and celestial bodies, many technological processes can be organized highly effectively. Mankind will remove from earth those energy installations that discharge heat that is harmful to the environment. [5]
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SHATALOV ANNOUNCES PLANS FOR ORBITAL FLIGHT OF POLISH COSMONAUT

Moscow TASS in English 0957 GMT 18 Apr 78

[Summary] Lieutenant General Vladimirov Shatalov, who directs the training of Soviet cosmonauts, has announced to TASS that a Polish cosmonaut will take part in the international expedition which will be launched some time after a Soviet crew has begun operations on board the "Salyut-6" station. He said that preparation for the flight is virtually complete and training specialists are satisfied with the crews' performances. [5]
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DETAILS OF "PROGRESS-1" REFUELING OPERATION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 3 Feb 78 p 3

[Article by G. Lomanov: "Operation 'Fuel'"]

[Excerpt] The station orbit is decreasing slightly; fuel is needed to "raise" it. In order to point the instruments on a constellation of interest to scientists and in order to intercept the required region of the earth's surface in the camera sight the cosmonauts orient the station, again requiring the expenditure of fuel. Its supply is limited; it is exhausted sooner than the station ends its life -- modern space scientific laboratories operate for years in orbit. When the fuel ends the research program ends, but the station itself can still serve man.

That is why it is difficult to exaggerate the importance of the operation, preparations for which Yu. Romanenko and G. Grechko began immediately after docking of the freight ship with the "Salyut-6." Refueling. The commonness of this word is misleading; it seems that the operation itself would present no difficulties. Something like fueling an automobile: stick a nozzle into the opening of the gas tank, press a lever, fill it up with gasoline and be on your way again.

"If only it was so simple," said the developers of the space refueling systems with a smile in response to these comments. "On the 'Salyut-6' both components of the space fuel, the fuel proper and its oxidizer, are stored in six leak-proof cylindrical tanks. There are separating membranes in these tanks, a sort of blacksmith's bellows, but made of metal. Nitrogen is fed into them under pressure from special spherical cylinders. The 'accordion' of the membrane is compressed and feeds fuel into the station's engines."

The nitrogen pressure in the tanks is approximately 20 atmospheres, whereas in the spherical cylinders it is 10 times greater. Visualize what pressure there must be in the tanks of the space "tanker" in order to force the fuel and oxidizer from them into the station's tanks. In order to create it, it would be necessary to take a great nitrogen supply aboard the transport ship. But the "Progress-1" is not only a "tanker," but also a "boxcar" which carries extremely diverse equipment.

"This means that the weight 'limits' here force engineers to solve really difficult technical problems."

"To be sure. We proposed a system like this: first the nitrogen is pumped from the tanks back into spherical cylinders. And when the pressure of the gas cushion in the station tanks is reduced to three atmospheres it is possible to open the valves of the main lines. Now the nitrogen pressure in the "tanker" tanks is greater and it is completely adequate to force the fuel and oxidizer into the tanks of the 'Salyut-6'."

In outward appearance "Progress" is practically indistinguishable from "Soyuz." This is understandable because it was designed on the basis of that ship. Its docking assembly, antennas and approach and docking systems are identical, but the automated equipment was enhanced to allow the ship to work reliably without cosmonauts.

Like "Soyuz," "Progress" consists of three compartments. The stern part of the ship is the instrument-assembly module, which contains the engine installation. In place of the former descent vehicle in the center section there is a compartment for transporting fuel. Here are tanks with fuel and oxidizers, automated pneumatic equipment, and pressurized tanks for pumping "food" for the engines. As distinct from "Soyuz," "Progress" is intended to work only on an earth-to-orbit route. Having completed its task of delivering supplies, it will not return to earth, but simply burn up upon entering the denser layers of the atmosphere. Therefore, in comparison with the "Soyuz" descent vehicle, the fuel component section on "Progress" has a greater "cargo-carrying capacity" because now the sturdy heat shield and parachute system are not needed. A cargo section occupies the space of the living or orbital compartment. Racks have been installed in it and large quantities of the most varied cargo totalling a considerable weight have been stowed away.

Borrowing a naval analogy, one can say that the "Progress" is a unique three-vessel "convoy": ahead, a cargo ship; in the middle, a tanker, and behind, a tugboat which leads it along the route by a "pushing" method. This unusual "convoy" is making its maiden voyage in the expanses of a black ocean -- space. And although it underwent a most thorough testing at its "wharf" on earth, a voyage, nevertheless, is a voyage, and the most critical operation -- "mooring" -- is being nervously awaited.

The pin of the "Progress" docking assembly is visible on a large scale on the screen. It constantly increases in size and the ship itself has already filled up the entire screen.

"We have contact!"

At 1312 hours Moscow time the transport ship "Progress-1" arrived at its space port. History's first cargo flight along an earth-to-orbit route has ended.

As Professor K. P. Feoktistov, one of the designers of "Salyut-6" and the transport ship "Progress-1" told reporters, "From the very beginning of work with orbital scientific stations we understood that for extended functioning it would be necessary to set up a resupply flow from earth to orbit. The fact is that in the process of operating the station there is a continuous expenditure of on-board supplies of food, water and even air. During every ejection, which is needed to remove wastes, a certain portion of the station's atmosphere is lost, which means that it must be replenished with nitrogen and oxygen. The emergence of cosmonauts into outer

space through the airlock chamber also represents an appreciable loss of atmosphere. Fuel is expended in orienting the station and correcting its orbit."

"Ensuring normal living conditions for the crew likewise requires definite expenditures. For example, the oxygen regenerators and filters which absorb harmful contaminants in the station's atmosphere must be periodically changed. Bathing uses up a great deal of water. Finally, there is a rather large category of expenditures such as underwear, napkins and towels."

"And most importantly, the extended functioning of the station requires periodic replacement of certain individual assemblies and components. After all, an orbital station is a most complex machine consisting of thousands of individual elements having varied reliabilities and resources. Some of them are intensively operated; others are not. Therefore, it is clear that preventive replacement of assemblies and units is plainly necessary for the reliable functioning of the entire complex, although it is impossible to have limitless reserves of spare parts."

"By the most conservative calculations, each day of the station's operation means an expenditure of 20-30 kg of supplies of various materials and equipment, the replenishment of which is necessary in order to ensure extended work in orbit. Therefore, cargo ships are no less needed than passenger ships for further exploitation of space. The successful flight of 'Progress-1' has shown that Soviet space technology has solved the problem of delivery of cargo into orbit and this has an enormous significance for rendering space habitable."

The red dot on the flight trajectory has disappeared from the screen in the main hall of the control center. Now there is only a blue one moving along and girdling our planet. Again a complex of three spacecraft is functioning in orbit, this time with a cargo unit. With time, of course, they will change and improve -- both the orbital stations and the cargo-passenger and purely cargo transport ships -- but a foundation has now been laid in plain view. Three basic "blocks" have been created, with the help of which it will be possible to conduct all types of construction in space and begin its habitation.

The flight of cosmonauts Dzhanibekov and Makarov aboard "Salyut-6," where the primary crew, Romanenko and Grechko, have worked for a long period of time shows that it is possible to accomplish an exchange of returnable transport ships, change crews without temporarily closing down the station, accomplish rescue missions and convey needed specialists and repairmen into space in a short time. Now after the mooring of "Progress-1" it is clear that delivery of all types of cargo and fuel to orbital stations and replenishment of all expended supplies is possible. It has been shown in principle that space stations can operate until they become, for all practical purposes, obsolete. The dream of space settlements which can exist for many years is beginning to come true.
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NEW EQUIPMENT ABOARD "SALYUT-6" DESCRIBED

Moscow PRAVDA in Russian 28 Jan 78 p 3

[Article by B. Adamovich: "Vital Supply"]

[Text] On 22 January for the first time in the history of spaceflight the automatic transport craft "Progress-1" delivered about two tons of assorted freight to the manned scientific research complex "Salyut-6"-"Soyuz-27." It is significant that among the freight were materials for the crew's life support system.

The increase in the length of near-earth flights and the significant broadening and complexity of the scientific research program being undertaken by cosmonauts has led to more and more attention being paid to on-board life support systems -- to increasing their reliability and to creating more comfortable conditions for the crew. As early as 1935 S. P. Korolev, working on the unsolved problems of manned flight in the stratosphere, said, "We shall examine the characteristics of rocket vehicles using liquid-fueled engines. The first thing is the crew... The second is the vital supply. The latter includes all equipment, instruments and devices for supporting the life conditions of the crew."

This complex of equipment, instruments and devices is now called the life support system. It is constantly being improved, and each new orbiting station of the "Salyut" family is being augmented with equipment which improves the living conditions on board. "Salyut-6" is no exception in this sense.

What innovations does it have? Let us first consider the shower equipment or, as its developers call it, the system for taking water procedures. It is the first time in Soviet astronautics that it has been used. The system is quite simple, but its simplicity is the result of long experimental work. The shower booth is an elastic cylinder with two hoods on which are placed fixtures for mixing and spraying hot and cold water, for supplying hot air and for removing the mixture of used water and air.

New agents for disinfecting the inside surfaces of instruments and equipment are used in the "Salyut-6."

The oxygen replenishment system and water supply system have not undergone significant changes. The former reliably supplies the crew with oxygen, absorbs carbon dioxide and harmful impurities, removes odors and dust, and also equalizes the pressure between the sections of the station and the transport craft after docking and compensates for possible gas leaks. The main drinking water supply is water kept fresh by silver ions created by an electrolytic method. The water supplies brought from earth are replenished by a system which recovers drinking water from the station's atmosphere.

Energy expenditures on the part of the crew have increased because more complicated and labor-consuming programs are being carried out, some of which require the cosmonauts to work in spacesuits. For this reason the caloric intake has been increased to 3,300 calories per day. The variety of foods has been increased. This has allowed an assortment of meals and a change from a three-day to a six-day series of menus. There are now on board a greater amount of dehydrated -- almost completely waterless -- foods. An improved food heater can heat canned meat food in tubes and bread simultaneously.

As shown by objective data and by reports of the cosmonauts, the "Salyut-6" life support system is working normally and is creating for the crew all conditions necessary for the successful completion of the flight program. At present just about everything needed for normal human activities in spaceflight is brought from earth. This is a very considerable supply. One must also keep in mind that extended storage of food and other materials is a very difficult problem.

What is the solution? There is but one: to create life support systems based on the physicochemical and, in the future, bioengineering cycling of materials. The first steps have already been taken: on board "Salyut-6" there is a working system which replenishes water from condensed atmospheric moisture. In the near future there will be new systems which will recycle other products of human activity. And, finally, years of intense work are required to create a closed ecological system which will be a miniature model of the natural (earth) biocoenosis. Similar ideas were expressed earlier by K. E. Tsiolkovskiy and F. A. Tsander.

However, an ecological system in space need not copy the earth's system exactly. In a small closed area it is impossible to recreate all the biochemical processes which take place on earth and which form the cycle of materials. Let us say that the length of the cycle required to renew the oxygen in our planet's atmosphere completely is about 2,000 years. Scientists developing space ecosystems see their task as the development of what is necessary but sufficient for ensuring the rapid circulation of materials in a limited space. They will do this by using the achievements of technology, physics, chemistry and medicine and by taking into account the laws governing the interdependence between numerous forms of living organisms and the environment, as naturally takes place on earth.

The solution to this problem will make it possible for people not only to complete long space flights and settle nearby planets, but it will also, apparently, open the road to the far reaches of the universe.
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COMMENTS ON DOCKING OF "PROGRESS-1"

Moscow IZVESTIYA in Russian 24 Jan 78 p 2

[Article by B. Konovalov: "The Transport Has Arrived at the Space Port"]

[Text] In the upper right-hand corner of the screen in the main hall of the control center we saw a large, shining figure somewhat resembling a chess pawn in outline. This was "Progress-1," history's first cargo spaceship, which was nearing its designated "port" -- the "Salyut-6" orbital station.

The previous day we met with the crew of the guest expedition which had been on board "Salyut-6," Vladimir Dzhanibekov and Oleg Makarov. At the traditional press conference at Zvezdnyy Gorodok, Makarov, in answer to a question concerning what struck him most during the flight, said with a feeling of genuine amazement: "The moment of meeting with the station. There in the sky it seems fantastic that all of the ballistics could be so precisely calculated to arrange a rendezvous at the exact time with the space apparatus in this starry abyss."

The precise, irreproachable work of automated equipment at all stages of flight struck Vladimir Dzhanibekov, who had been in space for the first time.

The automated equipment is also working excellently today. "Progress-1" is methodically accomplishing one maneuver after another, gradually increasing in size and nearing the station.

"The crew is doing a good job there, giving the necessary information to the 'Progress-1' on-board computer."

According to instrument readings on the control panel at the station's main post, Romanenko and Grechko are controlling the range, speed and angular attitude of the "Progress" and are seeing its maneuvers on an on-board television monitor. The same rear-mounted television camera on "Salyut-6," which showed us the docking of "Soyuz-26," is now reporting the approach of the "Progress-1." Dzhanibekov and Makarov brought on board "Salyut-6" a videotape of the link-up of "Soyuz-26." Romanenko and Grechko were repeatedly able to watch how they themselves had linked up and compare it with what was now taking place. After all, "Progress-1" was being moored to the station's same stern docking assembly. Thus, the docking picture should be exactly the same if everything were going correctly. So far there have been no deviations.

On the screen we see flashes erupt from the stern of the "Progress." This is the engine assembly working as it accelerates the ship in accordance with calculations of the on-board computer.

"Preparations for the refueling lasted a week. What was responsible for such a long time?"

"First, some time is required for checking the main lines. Second, it is possible to pump the nitrogen from the station tanks back into the spherical cylinders only using a quite powerful compressor. We recall: the pressure in the spheres is more than 200 atmospheres. The compressor motor, supplied current from the buffer batteries of the station, takes much energy. Time is also spent in the charging of the buffer batteries from the solar cells of the 'Salyut-6'."

"But the principal factor, to be sure, is that all these days Yuriy Romanenko and Georgiy Grechko are engaged not only in preparations for the refueling; they are transporting and placing other freight in the station compartments. Finally, it must be remembered that we pump the fuel and oxidizer separately. This means that the process takes twice as long." [298]

FEOKTISTOV FORESEES COMMERCIAL VALUE OF COSMONAUTICS

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 16 Mar 78 p 2

[V. Zubkov interview with K. Feoktistov: "An Orbit of Optimism"]

[Excerpt] For the time being there is no unanimous opinion: will cosmonautics follow the path of manned flights or will preference be given to automated mechanisms? Most leading problems, such as astrophysical investigations and the monitoring of natural resources, etc., can be solved by means of automatic vehicles. The prospects for manned orbital stations, possibly, are related to industrial construction in orbit.

But this is my subjective point of view, which many, probably, will not share. However, I feel that in the coming decades the developing technology will make it possible to solve the problem of creating in terrestrial orbit systems of energy satellites with an area of about tens of square kilometers. Such giants will transform solar energy into electric power and by means of radio waves will transmit to the earth a power of tens of millions of kilowatts.

The creation of such giants will require the implementation of industrial construction in space. This means that millions of tons of equipment and materials must be put into orbit where it will be necessary to construct factories for the transformation of these materials into construction parts which will be assembled into giant constructions. However, such production will scarcely be completely automated. Without question, automatic equipment will be used there, but the assembly and control of the entire process will probably remain to people and large teams of men will undoubtedly participate in the creation of such giant structures.

The roads to this end are still distant and long. But the experience of man's prolonged presence in space, the development of means and methods for the approach and docking of ships, the possibility of putting freight into orbit, this is the very experience which we can then use for industrial activity in orbit. I think that such activity is ahead of us.

To be sure, there can also be another direction in industrial activity in space. For example, it may prove to be desirable to construct factories in orbit for the production of materials under weightlessness conditions. These can be ultrapure metals, semiconductors, ultranew biologically active substances, drugs, etc.

However, if one speaks of the main lines in development of cosmonautics in general, then in my opinion the principal condition for most projects must be profitability.

Without question, curiosity has been a considerable stimulus in our activity. And it will probably also motivate us in the future. But in the immediate neighborhood of the earth there is scarcely anything that interesting. But if we succeeded in finding life on Mars and learned to understand its genetic code, this would be extraordinary and extremely interesting, but there are scarcely great hopes for this.

But there is hope for economically profitable activity of the type I mentioned. And possibly this will become the principal condition for the development of space technology. It is another thing that such a direction is not being formulated at once, but I emphasize that these are my subjective points of view.

In addition to the use of circumterrestrial space and planetary cosmonautics it is necessary, to be sure, to define still another direction -- fundamental investigations, in particular, the creation of powerful tools for astrophysical research, operating in different spectral ranges.

An enormous increase in the scales of projects and the necessary volume of material means: such is one of the trends in the development of cosmonautics which it is not difficult to note.

The efforts of only a single country are obviously inadequate for their implementation and therefore international cooperation with each passing year is assuming ever-greater timeliness. And the appearance in space of an international crew, within the "Interkosmos" program carrying out a series of interesting experiments, is indisputably a remarkable phenomenon. This gives us the right to speak of the beginning of a new, international stage in the exploitation of space.
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COMMENTARY ON SPACE PHOTOGRAPHY WITH "MKF-6M" CAMERA

Moscow IZVESTIYA in Russian 20 Jan 78 p 4

[Article by B. Konovalov: "Rainbow Over the Planet"]

[Text] At the International Astronautical Congress which met in Prague in the autumn of last year the Soviet cosmonaut Vladimir Aksenov gave a report to the assembled scientists.

During his flight aboard "Soyuz-22" with Valeriy Bykovskiy, he and his companion tested the new space photosystem MKF-6, developed jointly by Soviet and GDR experts and built at the VEB Karl Zeiss Jena Works. Test results confirmed the soundness of the design and the MKF-6 camera was then considered to have good prospects for routine use in photographing the earth from space to satisfy the needs of the national economy.

And now, indeed, these prospects have become a reality. Yuriy Romanenko and Georgiy Grechko have begun photographing the earth with the MKF-6M from the long-term "Salyut-6" orbital station.

"Whereas the work of the cosmonauts aboard 'Soyuz-22' was fundamentally of an experimental and scientific character," said Ya. Ziman, Department Head at the Space Research Institute USSR Academy of Sciences, to the reporters, "it was decided to devote 90% of the picture taking on this flight to the needs of the national economy and only 10% to scientific research. Since every space photo is of interest to many branches of the national economy the information from space will be processed as needed by the 'Priroda' State Center and distributed to all interested parties for practical utilization."

During the flight of the "Soyuz-22" the weather was far from perfect. Extensive cloud formations hid the earth's surface over wide areas. The beginning of the current experiment however has met with good weather conditions over the photographed territory.

"The weather is great," the "Taymiry" tell us.

"We try to do our best for you," cheerfully answer the ground crews, as if indeed they could already control the weather.

Far away in the sky, a new space experiment called "Raduga" has begun. The MKF-6M camera takes pictures with six lenses, each in a different spectral band, as if in six colors. The same picture, each in its own color, is simultaneously recorded six times on film contained in six separate cassettes. Back on earth, the pictures are processed by a special projector built at the National Karl Zeiss Jena Works. From four black and white photos, this complicated optical device produces synthesized images with

excellent definition of quite small detail, enlarged five times. By combining the composites obtained from photos taken in different spectral bands it is possible to isolate in a conventional color any natural feature of interest, such as forests and damaged or ripe grain fields.

Photography in different parts of the spectrum supplies additional information about the optical properties of the atmosphere and its pollution. It also has its own "depth vision" due to the fact that it photographs reflected solar radiation of different wavelengths which penetrates water to different depths. Thus, the pictures of Lake Baykal taken from "Soyuz-22" traced in depth the confluence of waters from the Selenga River and the lake. On the surface, the water was clean, but the other five levels revealed that the waters of the Selenga River bring into Lake Baykal pollution which increases with depth.

After the "Soyuz-22" test flight, the MKF-6 equipment was improved and adapted for service aboard long-term orbital stations. The reliability was increased and a backup electronic system as well as two additional cassettes were added, which is the reason why the suffix "M" for "modified" was appended. At the present time, the MKF-6M camera is on its maiden voyage. Each frame taken from "Salyut-6" covers an area of 165 x 220 km. There is enough film in each cassette to photograph more than ten million square kilometers of the earth's surface.

It is now winter in the northern hemisphere. Winter picture taking has its uses. It is valuable in forestry because it makes it easier to distinguish between conifers and deciduous trees and it is necessary in agriculture because it can be employed to forecast snow accumulation on the fields.

When work with the MKF-6M equipment was begun, a group of specialists from the GDR, headed by Professor Hans Fischer, Director of the Electronics Institute of the GDR Academy of Sciences, came to the flight control center.

"Until the 'Soyuz-22' flight," he said, "one sometimes heard that a country as small and as well charted by naturalists as the GDR had no need for space photography. But although we received only 30 pictures of GDR territory not completely covered by clouds, when they were processed in the Earth Physics Institute of the GDR Academy of Sciences they yielded a great deal of new and unexpected information about our country's geological structure and about the relative distribution of the large "plates" of the earth's crust.

Professor H. Fischer points out that not only the immediate benefits of space research advances are of great importance, but also the indirect ones such as the utilization of these advances in the traditional terrestrial branches of the national economy.

"Our Electronics Institute of the GDR Academy of Sciences," says H. Fischer, "designed on-board space instrumentation from the very beginning, when the first satellite of the 'Interkosmos' series was launched. We are using

the wealth of experience which we have amassed for the national economy. The various branches of our industry will be informed of those of our achievements which they can employ. At the present time there are three types of devices which our technology can use. In the first place, we have high-quality, compact and reliable humidity, temperature and pressure detectors which can be utilized in industry, for instance, in factories producing television picture tubes, locomotives, turbines and diesel engines. Secondly, the telemetric systems developed for satellites can be employed under terrestrial conditions to monitor various engineering processes and to obtain quickly information from a great number of places in a convenient form. The third possibility is the utilization in earth-bound technology of memory elements designed for satellite use."

Not one of the CEMA member countries, other than the USSR, could undertake space research on its own. However, since the Soviet Union has extended to its partners the use of its launching pads, rockets, ground flight tracking stations, space information processing centers, weather and communications satellites and spacecraft for joint work under the "Interkosmos" program, the socialist countries can fully participate in the revolutionary possibilities opened up by space research to science and the national economies.

The international division of labor and the utilization of each partner's strengths will raise the effectiveness of the space programs and ensure rational resource utilization, as well as the attainment of each partner's scientific potential. Space is needed by all and to master it, it pays to use joint efforts.
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INTERVIEW WITH DIRECTOR OF COSMONAUT TRAINING SHATALOV

Warsaw PERSPEKTYWY in Polish No 4, 27 Jan 78 pp 6-7

[Article by Tadeusz Haluch: "With General Vladimir Shatalov on Space and Other Things"]

[Text] If a group of cosmonauts preparing themselves for space flights can be compared to a national sports team, then their coach and selector is Lieutenant General Vladimir Shatalov. Before he took over this highly responsible function, General Shatalov "played on the national team" three times. If it could be said that anyone knows space, that person is General Shatalov.

The general was there the first time on 14 January 1969 aboard "Soyuz-4." He flew, or it should be said, he orbited in "Soyuz-8," as well as in the excellent company of "Soyuz-6" and "Soyuz-7." Finally, in 1971, aboard

"Soyuz-10" he accomplished the first linkup in space of this relatively small spacecraft with the powerful "Salyut" scientific research space station, a true multiton laboratory operating in orbit around the earth.

Thus, General Shatalov has a rich outer space biography. Nature likewise equipped him with many qualities which have facilitated his performing the responsible function of Director of Cosmonaut Training. He is a chief who has extensive professional knowledge. He is calm, level-headed and never says "I personally think..." He is analytical and probably is a good psychologist who does not depend on intuition in his selection of candidates for flights, but on precise verifiable data. If intuition enters the picture he strives to support it by specific material in the possession of all the commission members selecting flight candidates. It is clear that the decision to send a person into space is not an easy one. It is not the same as sending a driver with a car out on the road. The decision has to be preceded by a scrupulous analysis; all elements of the situation, actual as well as potential must be considered. In addition to his experience with space, General Shatalov also has a good stock of "worldly experience." He experienced the bitter taste of war as a youth in Leningrad. He managed to get away successfully before the Hitlerian pincers closed on that city and is well acquainted with war's wandering, its hunger, cold and ill treatment. Afterwards, he was able to devote himself to his dream -- the air service. He completed the Kaczen Flying School in 1956, an academy which now bears Gagarin's name. He became part of the cosmonaut group in 1963. Without a doubt, this group is comprised of aviators having the highest general and professional qualifications, the flower of Soviet aviation. General Shatalov became a petal of this flower -- not a bad one.

The General came to the Polish Radio and Television Office in Moscow the day after the exceptional feat of Soviet cosmonautics, the successful linking of "Soyuz-27" with the space scientific research complex consisting of the orbital station "Salyut-6" and the spacecraft "Soyuz-26." Cosmonauts Romanenko and Grechko had already been operating their unusual craft more than a month. Millions of TV viewers watched them unpacking souvenirs from earth, taking delight in reading letters from home and reading current news publications. Without a doubt, the television report of the meeting of the two space crews was the most sensational program of Soviet television in the entire history of its existence.

The general found time to break away from the feverish atmosphere of the flight control center to come to No 9 Marchlewski Street in his black Volga. Although I am a layman, I assumed that I was tearing him out of the eye of a cyclone and that it was the worst time for him for interviews and chats. So I asked immediately, "How much time do you have General?" "As much as you want," he answered calmly, taking off his karakul fur coat with the lieutenant general insignia. In the glitter of the lights in our studio flashed two gold stars of a Hero of the Soviet Union.

"General...I said warmly -- we welcome you here. First of all, I sincerely congratulate you on the brilliant success of Soviet space navigation, the linking of the 'Soyuz-27' spacecraft with the manned complex 'Salyut-6' and 'Soyuz-26.' Please tell us what is the significance of this event."

"I could describe that in one sentence: the first occurrence in history. We created an entire scientific research complex in orbit consisting of an orbital station and two spacecraft for the first time in history. You saw how Romanenko and Grechko greeted their colleagues Dzhanibekov and Makarov who, in short, arrived from earth just as one arrives by plane at a specific city. Thus, we created a complicated manned space vehicle. This is an important event in the history of space navigation. It could not have been accomplished without an enormous amount of work by scientific research, and of course, engineering groups. Please note that 'Soyuz-27' linked up with the 'Salyut' with the use of the second docking unit. I am unable to say what possibilities are created by our last experiment. We proved that it is possible to build large-sized objects in earth orbit and that crews of flying laboratories can be replaced. What we put into orbit weighs as much as three railroad coaches. This is just the beginning. We already know that the entire space train is an undertaking for accomplishment. This success makes us happy. It is a great success and Romanenko, Grechko, Dzhanibekov and Makarov are 'fine fellows.' This double coupling of the 'Soyuzes' with 'Salyut' opens up new, unlimited prospects in the process of learning and mastering space. This is in the interest of science as well as of our national economy. For we are living on earth and off of the earth...".

Despite the fact that our talk is taking place in front of a film camera, it has a completely peaceful character. General Shatalov is a splendid conversationalist. His memory is excellent and his reflexes are perfect. After all, who ought to have perfect reflexes if not a person who dispatches entire crews beyond the zone of the earth's gravity, and daily lives at the edge of earthly and cosmic matters? While the operator is changing the film reel, we talk about our favorite poets, and when the camera whirs again, the general spills over with information about space. Russians speak of people like this as a "real man" to which they add "excellent fellow." This characterizes Shatalov.

My second question was: "General, you are in charge of the training of Soviet cosmonauts for flights in space. Can you tell us what your work is like, or perhaps more realistically and concretely how you worked with this valiant quartet of cosmonauts who are now circling the earth together in a scientific research capsule?"

"The work of preparing cosmonauts for flight is a long and arduous one both for us and for them. There are no jokes here. It is necessary to give one's all, to prove oneself. Big things are involved. There is a rigorous program of training in existence. This is not a university where a lecture can be missed. We cannot skip anything. Up in space, you're not going to be able

to make excuses, you either know and are able to do something or not. It's that simple."

The general is a tall, handsome man. People like him were not sent into space earlier. The first cosmonauts were not very big or heavy so that they could fit in the necessarily limited confines of the small spaceship cabins. This consideration does not play a fundamental role today. Rocket launching capabilities and space vehicle weights and volumes are constantly becoming greater. When I viewed the model of the "Vostok" located in the Gagarin Museum at Zvezdnyy Gorodok which was used to thrust man into space, one of the reporters shouted: "That really is a bullet!" "Yes, it really was a big bullet, but how primitive a one compared to today's 'Soyuzes,' not to mention the 'Salyut' orbital station, in which it is possible to do exercises and to pedal a bicycle, in place, for the time being. For the time being!"

My last question was: "We know that flights of Soviet cosmonauts with cosmonauts of other socialist countries are being worked on. Naturally, we are interested in Polish cosmonauts. When will the first Pole find himself in space? All of Poland is asking this question. I know that the answer is not simple. I can therefore formulate the question in another way. What do the preparations for such flights under the aegis of our socialist partnership look like?"

Shatalov smiled and said: "It is, of course, difficult to answer that question. Your pilots are undergoing the normal training cycle. We are completing crew selection and are trying to make the best possible choice of crew members who will cooperate ideally with each other. This is a very complicated task..."

I interrupted here: "Do our boys work well?" The answer was: "Very well. They're fine fellows." "One thing more Comrade General. When the first Pole starts out in space, something which will be a great holiday for our country, I ask but one thing, please arrange for me to interview him when he comes back because I won't get into orbit with my camera and tape recorder ..."

"I can promise you that you will get that interview. Although I myself do not yet know with whom. Please understand that these are matters for publication after and not before the fact."

This was the end of the interview for television. But I still talked to Lieutenant General Shatalov for quite a long time.

"What were your impressions as you looked at earth from orbit?"

"You know, it's like this: we pilots of the most modern planes are accustomed to viewing earth from high altitudes. However, I must say that I did not experience any special impression. Everything, to be sure, is on a condensed

scale, but we are used to that. I remember clearly the Strait of Gibraltar, the coast of Africa as sharp as on a map, the outlines of entire continents and the lights of large cities. All this is hazy, as it were, somewhat unreal. The distance from earth does not play the role we imagine it does. What difference does 30 or 80 kilometers closer or further from earth make? That is how it is, I do not want to exaggerate. We cannot grow emotional. We leave emotions to others. We are made of the same clay but that clay must withstand states of overloading and weightlessness. I say this honestly because we cosmonauts are regarded as superhumans. You were at Zvezdnyy Gorodok, you saw how we live. Normally. We land softly (a smile) and almost always in Kazakhstan near Karaganda."

The conversation descends to the earth's hard surface. From weightlessness to the most perceptible of gravities. Here too Shatalov is an individualist. Is it not strange that a person can fly in space, observe the earth like a ball thrown into the infinity of the universe and on coming back have nothing to say? The general is one of those people who have something to say in the area of the earth's gravity as well as beyond it. During my lifetime I have talked to thousands of people, and speaking frankly, have rarely had a feeling of satisfaction following those talks. However, I was satisfied after talking to Shatalov. Fully satisfied.

Finally, we talked about families, about how time passes relatively quickly, and the clock ticks for all -- cosmonauts and miners, reporters and people who work with shovels.

We talked about children. The general has two of them. What kind of world will it be when the names Gagarin, Beregovoy, Tereshkov and Shatalov fade in history textbooks? His wife is an agricultural engineer. Space science is already beginning to help agriculture, it distinguishes areas of anticipated drought and warns of cyclones spotted from above.

I looked at General Shatalov and thought to myself: physically perfect persons do exist. With a heart, blood, pressure, liver, stomach and pancreas just as God enjoined. Also with a mind which functions like the highest quality watch. When I hand the general some kind of text to read, I see that he reaches into his pocket for glasses. So? Would every man under 50 have to use some kind of prosthesis? Even the director of cosmonaut training? That gesture, that reaching for eyeglasses brings a man closer to us than an account of three space flights. For even when we are flying in space we are transporting with us this arduous, inalienable baggage from which we cannot and do not wish to free ourselves at any price. Our inner self. [271]

Abstracts of Scientific Articles

PULSATIONS OF MAGNETIC FIELD BEFORE SOLAR FLARES

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 4, No 3, 1978 pp 143-144

[Article by M. V. Bystrov, M. M. Kobrin and S. D. Snegirev, Scientific Research Radiophysics Institute, "Pulsations of the Earth's Magnetic Field Before Solar Proton Flares"]

[Abstract] An attempt was made to clarify whether there is any influence of specific "preflare" solar activity on the earth's magnetosphere. The authors used data on the H component of the earth's magnetic field obtained at Borok station. The data were obtained during the periods 29 July to 1 August 1972 and from 30 June to 3 July 1974. The data were broken down into 14-hour intervals and subjected to spectral processing. There was found to be quasiperiodic pulsations with periods of 20-200 minutes, intensifying sharply prior to flares. The components of the spectrum of fluctuations with periods of 65, 90 and 180 minutes correlate with similar pulsations in solar radioemission. Due to the lack of adequate statistics, for the time being it cannot be said with assurance that the high correlation is not random.
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STABILITY OF LAGRANGIAN SOLUTIONS FOR CRITICAL RATIO OF MASSES

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 4, No 3, 1978 pp 148-152

[Abstract] In an earlier study (PMM, 39, 366, 1975) the author examined the problem of the stability of Lagrangian solutions of the circular restricted three-body problem with a critical ratio of masses of the principal attracting bodies. In the considered case for the plane problem motion is described by a two-dimensional Hamiltonian system, the frequencies of the linear system are equal and the elementary divisors are not simple. It was concluded that there is a formal stability of Lagrangian solutions. Now, on the basis of the results presented in this new paper, it can be asserted

that Lagrangian solutions of the plane circular restricted three-body problem with a critical ratio of masses are stable in the Lyapunov sense. Thus, the problem of Lyapunov stability of Lagrangian solutions of the plane problem has been solved rigorously for all physically admissible values of the parameter.
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